

**BIODEGRADABLE PLASTIC COMPOSITION**

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Inventor(s): TAKAHASHI SHUICHI; MARUYAMA TERUYOSHI  
Applicant(s): TAKAHASHI SEISAKUSHO:KK;; DAIMARU SHOKAI:KK;; NAKAIZUMI KIGYO:KK;;  
GLOBAL SANGYO KK  
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**Abstract**

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**PROBLEM TO BE SOLVED:** To obtain the subject composition containing a biodegradable plastic, starch (derivative) and saccharides at a specific ratio, excellent in moldability, capable of completely degrading in a short time by microorganisms in soil after pollution and useful for films for agriculture and food containers, etc.

**SOLUTION:** This composition contains(A) 20-70 pts.wt. biodegradable plastic such as biodegradable aliphatic polyester obtained by carrying out polycondensation reaction of a polyol such as 1,4-butanediol with an aliphatic dicarboxylic acid such as succinic acid or adipic acid, (B) 30-80 pts.wt. starch (derivative) such as corn starch or acetylated material or (carboxyl)methylated material and (C) 3-30 pts.wt. saccharides such as maltose or sucrose and as necessary, further (D) a foaming agent.

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(71) 出願人 596039718

株式会社高橋製作所  
東京都江東区大島3-9-13

(71) 出願人 595092537

株式会社大丸商会  
東京都板橋区前野町6丁目5番12号

(71) 出願人 595033919

株式会社中泉企業  
東京都港区赤坂3丁目12番7号

(71) 出願人 596089584

グローバル産業株式会社  
東京都千代田区永田町2-14-3

(74) 代理人 弁理士 小松 秀浩 (外3名)

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(54) 【発明の名称】 生分解性プラスチック組成物

(57) 【要約】

【課題】 廃棄物処理が容易な生分解性プラスチック組成物を提供する。

【解決手段】 (A) 生分解性プラスチック20~70重量部、(B) 澱粉及び/又は澱粉誘導体30~80重量部、及び(C) 糖類3~30重量部からなる生分解性プラスチック組成物

## 【特許請求の範囲】

【請求項1】 (A) 生分解性プラスチック20～70重量部、(B) 澱粉及び／又は澱粉誘導体30～80重量部、及び(C) 糖類3～30重量部からなる生分解性プラスチック組成物。

【請求項2】 請求項1記載の組成物において、更に(D) 発泡剤を含有することを特徴とする発泡性生分解性プラスチック組成物。

【請求項3】 (A) 生分解性プラスチックが生分解性脂肪酸ポリエステルであることを特徴とする請求項1又は2記載の生分解性プラスチック組成物。

【請求項4】 (C) 糖類がショ糖であることを特徴とする請求項1又は2記載の生分解性プラスチック組成物。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、従来のプラスチックと同等の物性を有しながら、自然環境下において微生物により容易に生分解される生分解性プラスチック組成物に関する。

【0002】

【従来の技術】種々のプラスチック製品が大量に使用されるとともに、使用後に廃棄物となった際に、通常の条件下では分解せず、また微生物等による腐食分解されないことが問題となっていた。このため、従来より分解性プラスチックの研究が行なわれ、大別して(1)光感応性剤を加えたり、特定の光感応基を導入し光エネルギーでポリマー鎖が開裂して低分子化していく光分解性プラスチック、(2)土壌、水中、汚泥中などに生息する微生物によって最終的に二酸化炭素と水まで分解する生分解性プラスチック、及び(3)非分解性プラスチックに生分解性プラスチックをブレンドして、土壌中などで崩壊させる生崩壊性プラスチックが研究開発されつつある。

【0003】

【発明が解決しようとする課題】これらの分解性プラスチックは環境問題に対する意識の高まりとともに徐々に使われ始めているものの、現在多用されているプラスチック製品に代用されるには、物性面、分解容易性及びコストの点で更に改良が必要である。

【0004】

【課題を解決するための手段】本発明者は鋭意検討した結果、(A) 生分解性プラスチックと(B) 澱粉及び／又は澱粉誘導体からなる混合系に(C) 糖類を添加することによって上記課題が解決されることを見出し本発明に至った。

0重量部、及び(C) 糖類3～30重量部からなる生分解性プラスチック組成物。

【0007】(2) 上記(1)記載の組成物において更に(D) 発泡剤を含有することを特徴とする発泡性分解性プラスチック組成物。

【0008】(3) (A) 生分解性プラスチックが生分解性脂肪酸ポリエステルであることを特徴とする上記(1)又は(2)記載の生分解性プラスチック組成物

【0009】(4) (C) 糖類がショ糖であることを特徴とする上記(1)又は(2)記載の生分解性プラスチック組成物。

【0010】本発明の組成物を構成する(A)成分である生分解性プラスチックとは従来公知のものであり、に限定されない。生分解性プラスチックとしては、(1)的合成品、動植物の構成成分である天然ポリマー、基素材として微生物が作るポリマーなどが知られている

【0011】前記化学的合成品としては、脂肪酸ポリエステル、ポリ乳酸、ポリグリコリッド、ポリ酪酸など他、ポリビニルアルコール(PVA)やポリエチレンリコール、ポリアクリル酸のアルカリ金属又はアルカ

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土類金属による全部又は部分ケン化物などの水溶性のポリマーなどが例示される。

【0012】前記天然ポリマーとしては、セルロースキチン・キトサンなどが挙げられる。澱粉も生分解性天然ポリマーであり、多糖類であるが、本発明において澱粉は(B)成分として用いるので、(A)及び(C)成分からは除外される。

【0013】前記微生物が作るポリマーとしては、αヒドロキシブチレート(PHB)とポリヒドロキシノレート(PHV)の共重合体、ポリアミノ酸などが挙げられる。ある種の多糖類も微生物から作られるが、本発明において糖類は(C)成分として用いるので、(A)成分からは除外される。

【0014】これらの中で、1,4-ブタンジオールのポリオール類とコハク酸やアジピン酸のような脂肪ジカルボン酸を重縮合させて得られる生分解性脂肪酸リエステルが好ましい。

【0015】本発明において、生分解性プラスチック1種又は2種以上を用いることができる。

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【0016】本発明の(B)成分を構成する澱粉及び又はその誘導体としては限定されないが、トウモロコシの澱粉、ジャガイモ、さつまいもなどのいも類の澱粉、米類の澱粉、麦類の澱粉、これらのアセチル化物、ノル化物、アリル化物、カルボキシメチル化物が例示される。これらの中で、トウモロコシの澱粉(コーンシロ)が最も一般的であり好ましい。又、これらの誘

ントース、ヘキソース、ヘプトース、オクトース、ノノース、デコースなどが挙げられる。少糖類としては、麦芽糖、セロビオース、ゲンチオビオース、メリビオース、ラクトース、ツラノース、トレハロース、ショ糖、インサッカロースなどの二糖類、マルトトリオースなどの三糖類や四糖類が挙げられる。これらの中で汎用性、取扱容易性から二糖類が好ましく、特にショ糖が砂糖として市場に出ていることから好ましい。又、これらの混合物を用いることもできる。

【0018】本発明の生分解性プラスチック組成物は、所望する物性によって、(A)～(C)の各成分を広い範囲から選定することができる。一般的には(A)成分20～70重量部、(B)成分30～80重量部、

(C)成分3～30重量部からなる。又、生分解性は低下するが、上記成分に加えて公知の非生分解性ポリマーを適宜混合することもできる。

【0019】本発明においては、更に(D)成分として公知の発泡剤を含有させることにより発泡性組成物とすることもできる。発泡剤としては公知のものを通常用いられる量で用いることができる。

【0020】発泡剤としては、ブタン、ペンタン、ヘキサン、ヘプタン、オクタンなどの炭化水素、ハロゲン化炭化水素、水やそのマイクロカプセル化物、炭酸ナトリウム、炭酸水素ナトリウムなどの炭酸塩系発泡剤、アゾジカルボンアミド等の化学発泡剤が挙げられる。

【0021】本発明の熱可塑性ポリマー組成物の製造方法については特に制限はなく、上記(A)、(B)、及び(C)成分を所定の配合比でヘンシェルミキサーやタンブラーで混合した後、一軸あるいは多軸の押出機、パンバリーミキサー、ニーダー、ロールなどの公知の混練装置を用いて溶融混練することにより得ることができる。また、ヘンシェルミキサーやタンブラーなどによる原料の混合を省略して各種原料を別々のフィーダーを用いて溶融混練装置に供給し、混練して得ることもできる。又、ペレット化を省略して、各成分を粉状のまま混合して成形機に導入することもできる。

【0022】また、本発明においては、必要に応じて各種添加剤成分、例えば、可塑剤、滑剤、安定剤、酸化防止剤、紫外線吸収剤、難燃剤、離型剤などをポリマー成分のペレット製造時やポリマー成形体の成形加工時に配

合することもできる。

【0023】なお、本発明のプラスチック組成物を食器、玩具などに用いる場合には上記各種添加剤は食品着色剤などの人体に無害であることが既に知られたものを使用するのが好ましい。

【0024】本発明においては、更に非生分解性の熱可

により、プラスチック成形物はその形態を失うことになり、崩壊性プラスチックとして利用できる。

【0025】このような非生分解性可塑性プラスチックとしては、例えばスチレン系樹脂、オレフィン系樹脂、メタクリル系樹脂、ポリ塩化ビニル系樹脂、ポリ塩化ニリデン樹脂、ポリアミド樹脂、ポリエステル樹脂、リウレタン樹脂、ポリカーボネート樹脂、ポリアセタル樹脂、ポリフェニレンエーテル樹脂、フッ素樹脂及び各種の熱可塑性エラストマーなどが挙げられるが、これらの中でスチレン系樹脂、オレフィン系樹脂、メタクリル系樹脂及びポリ塩化ビニル系樹脂が一般的である。これらは2種以上用いることもできる。

【0026】このようにして得られた本発明の生分解性ポリマー組成物は、一般に熱可塑性ポリマーの成形にいられている公知の方法、例えば射出成形、押出成形、ブロー成形、インフレーション成形、真空成形などの法によって各種成形体に成形される。また、フィルム、二軸延伸フィルム、シート、発泡シート、発泡ビーズなどに成形された後、所望の成形体に成形される。

【0027】本発明の組成物は生分解性プラスチック原料を主成分とし、糖類を加えたものである。各成形物への成形が容易であり、その成形物は、プラスチックが有する各種物性を示すとともに、使用後は土壌水中、汚泥中などに生息する微生物によって完全に分解される。又、本発明のプラスチック製品は、生ゴミ月ンポストで処理すれば1日から数日程度の短期間で分解とすることができる。このような優れた性質を利用して、従来プラスチックが利用されてきた各種用途に本発明のプラスチック組成物は成形されて用いることができる。

【0028】本発明の好ましい用途について以下に列挙して説明する。

【0029】1. 杭、パイル類  
本発明の組成物の成形物は、土に直接使用すると、土埋めることにより土中の微生物により分解することになる。つまり、製品の使用と廃棄が同時に行なわれるという理想的な用途となる。具体的には、ゴルフ場、道端、河川などの方面に張られる芝などの杭、パイルとして用いられる。又、盛土、切り土などの工事後の緑化、イト張りにおいても使用することができる。同時に、従来の金網にかえてネット自体を本発明の生分解性プラスチック製とすることにより工事全体を生分解性とすることもできる。

【0030】2. シート、フィルム類  
生分解性が要求される用途、具体的には農業用ハウシート、農業用フィルム、各種包装用フィルム、建設・

箱、農園芸ポットなどに好適である。

#### 【0032】4. 発泡材料

本発明の組成物は、通常の射出成形機など公知の方法により容易に発泡させることができる。発泡倍率も2~3倍程度の低発泡から、20~30倍程度の高発泡まで調節可能である。

【0033】従来よりプラスチック発泡体が用いられた分野での使用が可能である。特に、低発泡体は電気製品のキャビネットなどに、自動車のハンドル、バンパー、内装品などに、包装用資材に適する。その他、家庭用内装品、ホテルの歯ブラシ、航空機内食用のスプーン、フォーク、食器及びトレイ、玩具類、エアガンの玉、文具など、その軽量性と安全性を念頭に入れた用途が含まれる。

【0034】高発泡体は、特に現在廃棄処分に問題がある発泡スチロールの代替材料として有効である。例えば、食品トレイ、インスタント通風の容器などの食器包装容器類、水産物・農産物用箱、包装用箱などの輸送用箱類、電気製品・精密機器の緩衝材などの緩衝材、建築用・道路用の防音・断熱材が好適である。

#### 【0035】5. その他

各種成形方法に適用できることを利用して、スリット繊維、不織布、ネット、ロープなどにもすることもできる。他、帽子、ポンチョ、ウィンドブレーカーなどの衣類、ゴミ袋、土産袋などの包装資材、スキーのポールなどの運動具等への適用ができる。又、テレホンカード、オレンジカード、パチンコカード、図書カードなどの各種プリペイドカード、各種クレジットカード、図書館利用\*

#### (A) 脂肪族ポリエステル

(昭和高分子製ビオノーレ1020)

#### (B) コーンスターチ

#### (C) ショ糖(砂糖)

上記各成分の混合物を射出成形機に供給し成形した。トレイ及び杭の金型を用いて成形品を得た。

【0040】得られたトレイ及び杭の外観は良く、添加したショ糖によるコゲ、変色等の発生は全くなかった。また、トレイ及び杭としての機械的強度等も十分であり、水による洗浄も可能であった。

【0041】土壌より採取して作成した培地中に、上記トレイ及び杭を埋め、室温下で3カ月間放置した所、ほぼ完全に生分解された。

【0042】比較のために(C)成分のショ糖を除外した他は同様の成形、及び分解を行った所、上記本発明の実施例によるもの比べて成形性が若干劣るとともに、※

\*カード、各種会員カードなど、大量に消費されたり、限があるため定期的に廃棄されるカード類への適用が効である。

【0036】なお、成形体の耐水性、耐薬品性、耐腐性、機械的強度などを更に高めたい時には、本発明の成物より得られた成形体の表面を各種材料で処理することもできる。例えば、アルミニウムなどの金属類、非分解性プラスチック類、より高融点のポリ乳酸などの生分解性プラスチック類で、コーティング、ラミート、ディッピング、又は蒸着等の処理が有効である。又、金属類や非生分解性プラスチック類で表面を処理する場合は、使用後の生分解性が低下することを防止するため、耐水性等を必要とする部分にのみ表面処理したり、非処理部分を部分的に残すなどの手段を講じることができる。

【0037】更に、抗、バイル類、ゴルフティ、農薬フィルム、苗ポット、農園芸用ポット等の土木緑化用農林業用、園芸用資材用品には、予めチッソ、燐、K等の公知の肥料、有効菌類を混練しておく、生分解に肥料分としてさらに有効となるので好ましい。またの添加割合は0~80%、好ましくは5~30%の量である。

#### 【0038】

【発明の実施の形態】以下、実施例により本発明をさらに詳しく説明するが、本発明はこれらの例に限定されない。

#### 【0039】実施例

47部

47部

6部

※土壌中での生分解も完全ではなかった。

#### 【0043】

【発明の効果】本発明のプラスチック組成物は、成形が容易であり、廃棄後は土壌中の微生物によって短時間で完全に生分解されるものである。よって、環境問題資源問題、ゴミ問題に極めて有用である。

【0044】本発明が上記のような格別優れた効果をする理由は必ずしも明確ではないが、第3成分としていたショ糖などの糖類が、プラスチック成形時に増育の機能を有するとともに、廃棄時においては微生物による生分解を促進する働きがあるためと思われる。

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CLAIMS

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[Claim(s)]

[Claim 1] (A) The biodegradable plastic constituent which consists of a biodegradable plastic 20 – 70 weight sections, (B) starch and/or the starch derivative 30 – 80 weight sections, and the (C) saccharide 3 – 30 weight sections.

[Claim 2] The fizz biodegradable plastic constituent characterized by containing the (D) foaming agent further in a constituent according to claim 1.

[Claim 3] (A) The biodegradable plastic constituent according to claim 1 or 2 characterized by a biodegradable plastic being biodegradability aliphatic series polyester.

[Claim 4] (C) The biodegradable plastic constituent according to claim 1 or 2 characterized by saccharides being cane sugar.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the biodegradable plastic constituent in which biodegradation is easily carried out by the microorganism to the bottom of natural environment, having physical properties equivalent to conventional plastics.

[0002]

[Description of the Prior Art] While various plastics were used for the large quantity, when it became trash after an activity, the thing which does not decompose on condition that usual and is depended on a microorganism etc. and which is not done for corrosion decomposition had become a problem. For this reason, research of a degradable plastic is done conventionally and it divides roughly, and (1) light-sensitive nature agent is added, or a specific light-sensitive radical is introduced and a polymer chain cleaves with light energy. A biodegradable plastic is blended to the biodegradable plastic which even a carbon dioxide and water decompose eventually by the microorganism which lives the low-molecular-weight-sized photodegradable plastic, (2) soil, underwater, into sludge, etc., and (3) nondegradable plastics, and research and development in the raw collapsibility plastics collapsed in soil etc. is being done.

[0003]

[Problem(s) to be Solved by the Invention] These degradable plastics still need to be improved in respect of a physical-properties side, decomposition ease, and cost, in order to substitute the plastic by which current multiple use is carried out, although gradually used [ beginning ] with the rise of consciousness to an environmental problem.

[0004]

[Means for Solving the Problem] this invention person resulted that the above-mentioned technical problem was solved in header this invention by adding the (C) saccharide to the mixed stock which consists of the (A) biodegradable plastic, (B) starch, and/or a starch derivative, as a result of inquiring wholeheartedly.

[0005] That is, this invention is the following (1) - (4).

[0006] (1) Biodegradable plastic constituent which consists of the (A) biodegradable plastic 20 - 70 weight sections, (B) starch and/or the starch derivative 30 - 80 weight sections, and the (C) saccharide 3 - 30 weight sections.

[0007] (2) The fizz biodegradable plastic constituent characterized by containing the (D) foaming agent further in the constituent of the above-mentioned (1) publication.

[0008] (3) Biodegradable plastic constituent the above (1) characterized by the (A) biodegradable plastic being biodegradability aliphatic series polyester, or given in (2).

[0009] (4) Biodegradable plastic constituent the above (1) characterized by the (C) saccharides being cane sugar, or given in (2).

[0010] The biodegradable plastic which is the (A) component which constitutes the constituent of this invention is conventionally well-known, and it is not limited especially. As a biodegradable plastic, the chemical synthetic substance, the natural polymer which is the constituent of animals and plants, the polymer which a microorganism makes as a raw material are known.

[0011] As said chemical synthetic substance, water-soluble polymers, such as all by the alkali metal or alkaline earth metal of the others and polyvinyl alcohol (PVA) which are aliphatic series polyester, polylactic acid, the Pori Glico lid, Pori butanoic acid, etc., a polyethylene glycol, and

polyacrylic acid, or a partial saponification object, etc. are illustrated.

[0012] A cellulose, chitin chitosan, etc. are mentioned as said natural polymer. Although starch is also the natural polymer of biodegradability and is polysaccharide, since starch is used as a (B) component in this invention, it is excepted from (A) and the (C) component.

[0013] As a polymer which said microorganism makes, the copolymer of polyhydroxy butyrate (PHB) and polyhydroxyvalerate (PHV), polyamino acid, etc. are mentioned. Although a certain kind of polysaccharide is also made from a microorganism, since a saccharide is used as a (C) component in this invention, it is excepted from the (A) component.

[0014] The biodegradability aliphatic series polyester which is made to carry out the polycondensation of aliphatic series dicarboxylic acid like polyols and succinic acids, such as 1,4-butanediol, or an adipic acid, and is obtained in these is desirable.

[0015] In this invention, a biodegradable plastic can use one sort or two sorts or more.

[0016] Although not limited as the starch which constitutes the (B) component of this invention, and/or its derivative, the starch of potatoes, such as starch of corn, a potato, and a sweet potato, the starch of rice, the starch of wheat, these acetylation objects, a methylation object, an allyl compound ghost, and a carboxyl methylation object are illustrated. In these, the starch (corn starch) of corn is the most common, and it is desirable. Moreover, such mixture can also be used.

[0017] The saccharide which constitutes the (C) component of this invention names monosaccharide and oligosaccharide generically. As monosaccharide, monose, diose, triose, tetrose, a pentose, a hexose, heptose, octose, the nonose, decose, etc. are mentioned. As oligosaccharide, trisaccharides and tetrasaccharides, such as disaccharides, such as a maltose, cello PIOUSU, gene thio PIOUSU, MERIPIOSU, a lactose, turanose, trehalose, cane sugar, and in saccharose, and a maltotriose, are mentioned. Versatility and handling ease to disaccharide is desirable in these, and it is desirable from especially cane sugar having come out to the commercial scene as sugar. Moreover, such mixture can also be used.

[0018] The biodegradable plastic constituent of this invention can select each component of (A) – (C) from the large range by the physical properties for which it asks. Generally, it consists of the (A) component 20 – 70 weight sections, the (B) component 30 – 80 weight sections, and the (C) component 3 – 30 weight sections. Moreover, although biodegradability falls, in addition to the above-mentioned component, it can also mix a well-known non-biodegradability polymer suitably.

[0019] In this invention, it can also consider as a fizz constituent by making the still better known foaming agent as a (D) component contain. A thing well-known as a foaming agent can be used in the amount usually used.

[0020] As a foaming agent, chemistry foaming agents, such as carbonate system foaming agents, such as hydrocarbons, such as butane, a pentane, a hexane, a heptane, and an octane, halogenated hydrocarbon, water and its microencapsulation object, a sodium carbonate, and a sodium hydrogencarbonate, and an AZOJI carvone amide, are mentioned.

[0021] After there being especially no limit about the manufacture approach of the thermoplastic polymer constituent of this invention and mixing the above (A), (B), and the (C) component with a Henschel mixer or a tumbler with a predetermined compounding ratio, it can obtain by carrying out melting kneading using well-known kneading equipments, such as an extruder of one shaft or a multiple spindle, a Banbury mixer, a kneader, and a roll. Moreover, mixing of a raw material with a Henschel mixer, a tumbler, etc. can be omitted, and various raw materials can also be supplied, kneaded and obtained to melting kneading equipment using a separate feeder. Moreover, pelletizing can be omitted, each component can be mixed in the powdery state, and it can also introduce into a making machine.

[0022] Moreover, in this invention, various additive components, for example, a plasticizer, lubricant, a stabilizer, an antioxidant, an ultraviolet ray absorbent, a flame retarder, a release agent, etc. can also be blended if needed at the time of pellet manufacture of a polymer component, and the fabricating operation of a polymer Plastic solid.

[0023] In addition, when using the plastics constituent of this invention for tableware, a toy, etc., as for the various above-mentioned additives, it is desirable to use that by which it was already known that it is harmless to the bodies, such as a food coloring agent.

[0024] In this invention, the thermoplastics of non-biodegradability can be further used together.



In this case, by the microorganism to which trash lives into soil etc., by decomposing the saccharide of the starch of the biodegradable plastic of the (A) component, and the (B) component and/or a starch derivative, and the (C) component, a plastic molding object will lose that gestalt and can use it as compressibility plastics.

[0025] As such non-biodegradability plasticity plastics, although styrene resin, olefin system resin, methacrylic system resin, polyvinyl chloride system resin, polyvinylidene chloride resin, polyamide resin, polyester resin, polyurethane resin, polycarbonate resin, polyacetal resin, polyphenylene ether resin, a fluoro resin, various kinds of thermoplastic elastomer, etc. are mentioned, for example, styrene resin, olefin system resin, methacrylic system resin, and polyvinyl chloride system resin are common in these. Two or more sorts of these can also be used.

[0026] Thus, the biodegradability polymer constituent of obtained this invention is fabricated by various Plastic solids by approaches, such as the well-known approach generally used for shaping of a thermoplastic polymer, for example, injection molding, extrusion molding, blow molding, inflation molding, and a vacuum forming. Moreover, it is fabricated by the desired Plastic solid after being fabricated by a film, a biaxially oriented film, a sheet, a foaming sheet, the foaming bead, etc.

[0027] Since the constituent of this invention uses a biodegradable plastic and starch as a principal component and a saccharide is added, while shaping to various moldings is easy and the moldings shows the various physical properties which plastics has, after an activity is thoroughly decomposed by the microorganism which lives soil, underwater, into sludge, etc. Moreover, the plastic of this invention can be used as fertilizer for a short period of time for the 1st day to about several days, if it processes with the compost for kitchen garbages. Using such an outstanding property, the plastics constituent of this invention is fabricated by the various applications for which plastics is used conventionally, and can be used for them.

[0028] The desirable application of this invention is enumerated and explained below.

[0029] 1. When the moldings of the constituent of a pile and pile this invention is directly used for soil, the microorganism in soil will decompose it by burying in soil. That is, it becomes the ideal application that an activity and abolition of a product are performed simultaneously. Specifically, it can be used as piles, such as grass stretched in the directions, such as a golf course, a route, and a river, and a pile. Moreover, it can be used also in the tree planting after work of landfill, a cut, etc., and a network flare. The whole work can also be made into biodegradability by changing to the conventional wire gauze and making the network itself into the product made from a biodegradable plastic of this invention simultaneously.

[0030] 2. It is suitable for the application and concrete target of which a sheet and films biodegradability are required to the house sheet for agriculture, the film for agriculture, the various films for a package, construction and the sheet for engineering works, a garbage bag, etc.

[0031] 3. Also in a container and a tray plastic, it is consumed especially so much and the disposal after abolition is suitable for the various difficult containers, tableware, a tray, a shipping box, a plantation art pot, etc.

[0032] 4. The constituent of charge this invention of foam can be made to foam easily by well-known approaches, such as the usual injection molding machine. Expansion ratio can also be adjusted from low foaming of about 2 to 3 times to high foaming of about 20 to 30 times.

[0033] An activity in the field for which plastics foam was used conventionally is possible. Especially low foam is suitable for the wheel of an automobile, a bumper, interior equipment, etc. with the materials for a package at the cabinet of an electric product etc. In addition, the application put in bearing in mind the lightweight nature and safeties, such as home interior equipment, the gear-tooth brush of a hotel, the spoon for aircraft eating in the household, a fork, tableware and a tray, toys, a ball of an air gun, and stationery, is included.

[0034] Especially high foam is effective as alternate material of the styrene foam which has a problem in current disposal. For example, shock absorbing material, such as shock absorbing material of boxes for transport, such as tableware containers, such as a container of a food tray and instant noodles, a marine product and the box for agricultural products, and a box for a package, and an electric product and a precision mechanical equipment, and the noise control and the heat insulator structural and for routes are suitable.

[0035] 5. In addition, it can also be made slit fiber, a nonwoven fabric, a network, a rope, etc. using being applicable to the various shaping approaches, and also application to motion

implements, such as the pole of packaging materials, such as clothing, such as a hat, a poncho, and a wind deflector, a garbage bag, and a souvenir bag, and skiing, etc. can be performed. Moreover, application on the card periodically discarded since various prepaid cards, such as a telephone card, an orange card, a pachinko card, and a books card, various credit cards, a library utilization card, various member cards, etc. are consumed by the large quantity or there is length is effective.

[0036] In addition, the front face of the Plastic solid acquired from the constituent of this invention can also be processed with various ingredients to raise further the water resisting property of a Plastic solid, chemical resistance, thermal resistance, a mechanical strength, etc. For example, processing of coating, a lamination, DIPINGU, or vacuum evaporation is effective at metals, such as aluminum, non-biodegradable plastics, and the biodegradable plastics of others more, such as high-melting polylactic acid. Moreover, since it prevents that the biodegradability after an activity falls when processing a front face by metals and non-biodegradable plastics, surface treatment can be carried out only to the part which needs a water resisting property etc., or means, such as leaving a non-processing part selectively, can also be provided.

[0037] Furthermore, to objects for engineering-works tree planting, such as a pile, piles, a golf tee, a film for agriculture, a seedling pot, and a pot for plantation arts, the object for agricultural and forestry industries, and the materials supply for horticulture, if well-known fertilizer, such as Chisso, phosphorus, and potash, and an effective fungus are kneaded beforehand, since it will become still more effective as a part for fertilizer after biodegradation, it is desirable. Moreover, the addition rate is 5 - 30% of rate preferably 0 to 80%.

[0038]

[Embodiment of the Invention] Hereafter, although an example explains this invention in more detail, this invention is not limited to these examples.

[0039] (Example A) aliphatic series polyester The 47 sections (Showa High Polymer Bionolle 1020)

(B) Corn starch 47 sections (C) cane sugar (sugar) The mixture of 6 section above-mentioned each component was supplied and fabricated to the injection molding machine. Mold goods were obtained using the metal mold of a tray and a pile.

[0040] The appearance of the obtained tray and a pile was good, and there was no generating of the scorch by the added cane sugar, discoloration, etc. Moreover, the mechanical strength as a tray and a pile etc. was enough, and washing by water was also possible.

[0041] the place which buried the above-mentioned tray and the pile and was left for three months under the room temperature in the culture medium collected and created from soil -- biodegradation was carried out nearly thoroughly.

[0042] While the moldability was inferior a little compared with the place which the cane sugar of the (C) component were excepted for the comparison, and also performed same shaping and decomposition, and the thing to depend on the example of above-mentioned this invention, the biodegradation in the inside of soil was not perfect, either.

[0043]

[Effect of the Invention] The plastics constituent of this invention is easy a moldability, and biodegradation of after abolition is thoroughly carried out by the microorganism in soil for a short time. Therefore, it is very useful on an environmental problem, a resource problem, and a dust problem.

[0044] Although the reason this invention does the above exceptionally excellent effectiveness so is not necessarily clear, it is considered because there is work to which saccharides, such as cane sugar used as the 3rd component, promote the biodegradation by the microorganism in the time of abolition while having functions, such as lubricant, at the time of plastic molding.

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TECHNICAL FIELD

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[Field of the Invention] This invention relates to the biodegradable plastic constituent in which biodegradation is easily carried out by the microorganism to the bottom of natural environment, having physical properties equivalent to conventional plastics.

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PRIOR ART

[Description of the Prior Art] While various plastics were used for the large quantity, when it became trash after an activity, the thing which does not decompose on condition that usual and is depended on a microorganism etc. and which is not done for corrosion decomposition had become a problem. For this reason, research of a degradable plastic is done conventionally and it divides roughly, and (1) light-sensitive nature agent is added, or a specific light-sensitive radical is introduced and a polymer chain cleaves with light energy. A biodegradable plastic is blended to the biodegradable plastic which even a carbon dioxide and water decompose eventually by the microorganism which lives the low-molecular-weight-ized photodegradable plastic, (2) soil, underwater, into sludge, etc., and (3) nondegradable plastics, and research and development in the raw collapsibility plastics collapsed in soil etc. is being done.

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EFFECT OF THE INVENTION

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[Effect of the Invention] The plastics constituent of this invention is easy a moldability, and biodegradation of after abolition is thoroughly carried out by the microorganism in soil for a short time. Therefore, it is very useful on an environmental problem, a resource problem, and a dust problem.

[0044] Although the reason this invention does the above exceptionally excellent effectiveness so is not necessarily clear, it is considered because there is work to which saccharides, such as cane sugar used as the 3rd component, promote the biodegradation by the microorganism in the time of abolition while having functions, such as lubricant, at the time of plastic molding.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] These degradable plastics still need to be improved in respect of a physical-properties side, decomposition ease, and cost, in order to substitute the plastic by which current multiple use is carried out, although gradually used [ beginning ] with the rise of consciousness to an environmental problem.

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## MEANS

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[Means for Solving the Problem] this invention person resulted that the above-mentioned technical problem was solved in header this invention by adding the (C) saccharide to the mixed stock which consists of the (A) biodegradable plastic, (B) starch, and/or a starch derivative, as a result of inquiring wholeheartedly.

[0005] That is, this invention is the following (1) - (4).

[0006] (1) Biodegradable plastic constituent which consists of the (A) biodegradable plastic 20 - 70 weight sections, (B) starch and/or the starch derivative 30 - 80 weight sections, and the (C) saccharide 3 - 30 weight sections.

[0007] (2) The fizz biodegradable plastic constituent characterized by containing the (D) foaming agent further in the constituent of the above-mentioned (1) publication.

[0008] (3) Biodegradable plastic constituent the above (1) characterized by the (A) biodegradable plastic being biodegradability aliphatic series polyester, or given in (2).

[0009] (4) Biodegradable plastic constituent the above (1) characterized by the (C) saccharides being cane sugar, or given in (2).

[0010] The biodegradable plastic which is the (A) component which constitutes the constituent of this invention is conventionally well-known, and it is not limited especially. As a biodegradable plastic, the chemical synthetic substance, the natural polymer which is the constituent of animals and plants, the polymer which a microorganism makes as a raw material are known.

[0011] As said chemical synthetic substance, water-soluble polymers, such as all by the alkali metal or alkaline earth metal of the others and polyvinyl alcohol (PVA) which are aliphatic series polyester, polylactic acid, the Pori Glico lid, Pori butanoic acid, etc., a polyethylene glycol, and polyacrylic acid, or a partial saponification object, etc. are illustrated.

[0012] A cellulose, chitin chitosan, etc. are mentioned as said natural polymer. Although starch is also the natural polymer of biodegradability and is polysaccharide, since starch is used as a (B) component in this invention, it is excepted from (A) and the (C) component.

[0013] As a polymer which said microorganism makes, the copolymer of polyhydroxy butyrate (PHB) and polyhydroxyvalerate (PHV), polyamino acid, etc. are mentioned. Although a certain kind of polysaccharide is also made from a microorganism, since a saccharide is used as a (C) component in this invention, it is excepted from the (A) component.

[0014] The biodegradability aliphatic series polyester which is made to carry out the polycondensation of aliphatic series dicarboxylic acid like polyols and succinic acids, such as 1,4-butanediol, or an adipic acid, and is obtained in these is desirable.

[0015] In this invention, a biodegradable plastic can use one sort or two sorts or more.

[0016] Although not limited as the starch which constitutes the (B) component of this invention, and/or its derivative, the starch of potatoes, such as starch of corn, a potato, and a sweet potato, the starch of rice, the starch of wheat, these acetylation objects, a methylation object, an allyl compound ghost, and a carboxyl methylation object are illustrated. In these, the starch (corn starch) of corn is the most common, and it is desirable. Moreover, such mixture can also be used.

[0017] The saccharide which constitutes the (C) component of this invention names monosaccharide and oligosaccharide generically. As monosaccharide, monose, diose, triose, tetrose, a pentose, a hexose, heptose, octose, the nonose, decose, etc. are mentioned. As oligosaccharide, trisaccharides and tetrasaccharides, such as disaccharides, such as a maltose,

cello PIOUSU, gene thio PIOUSU, MERIPIOSU, a lactose, turanose, trehalose, cane sugar, and in saccharose, and a maltotriose, are mentioned. Versatility and handling ease to disaccharide is desirable in these, and it is desirable from especially cane sugar having come out to the commercial scene as sugar. Moreover, such mixture can also be used.

[0018] The biodegradable plastic constituent of this invention can select each component of (A) – (C) from the large range by the physical properties for which it asks. Generally, it consists of the (A) component 20 – 70 weight sections, the (B) component 30 – 80 weight sections, and the (C) component 3 – 30 weight sections. Moreover, although biodegradability falls, in addition to the above-mentioned component, it can also mix a well-known non-biodegradability polymer suitably.

[0019] In this invention, it can also consider as a fizz constituent by making the still better known foaming agent as a (D) component contain. A thing well-known as a foaming agent can be used in the amount usually used.

[0020] As a foaming agent, chemistry foaming agents, such as carbonate system foaming agents, such as hydrocarbons, such as butane, a pentane, a hexane, a heptane, and an octane, halogenated hydrocarbon, water and its microencapsulation object, a sodium carbonate, and a sodium hydrogencarbonate, and an AZOJI carvone amide, are mentioned.

[0021] After there being especially no limit about the manufacture approach of the thermoplastic polymer constituent of this invention and mixing the above (A), (B), and the (C) component with a Henschel mixer or a tumbler with a predetermined compounding ratio, it can obtain by carrying out melting kneading using well-known kneading equipments, such as an extruder of one shaft or a multiple spindle, a Banbury mixer, a kneader, and a roll. Moreover, mixing of a raw material with a Henschel mixer, a tumbler, etc. can be omitted, and various raw materials can also be supplied, kneaded and obtained to melting kneading equipment using a separate feeder. Moreover, pelletizing can be omitted, each component can be mixed in the powdery state, and it can also introduce into a making machine.

[0022] Moreover, in this invention, various additive components, for example, a plasticizer, lubricant, a stabilizer, an antioxidant, an ultraviolet ray absorbent, a flame retarder, a release agent, etc. can also be blended if needed at the time of pellet manufacture of a polymer component, and the fabricating operation of a polymer Plastic solid.

[0023] In addition, when using the plastics constituent of this invention for tableware, a toy, etc., as for the various above-mentioned additives, it is desirable to use that by which it was already known that it is harmless to the bodies, such as a food coloring agent.

[0024] In this invention, the thermoplastics of non-biodegradability can be further used together. In this case, by the microorganism to which trash lives into soil etc., by decomposing the saccharide of the starch of the biodegradable plastic of the (A) component, and the (B) component and/or a starch derivative, and the (C) component, a plastic-molding object will lose that gestalt and can use it as collapsibility plastics.

[0025] As such non-biodegradability plasticity plastics, although styrene resin, olefin system resin, methacrylic system resin, polyvinyl chloride system resin, polyvinylidene chloride resin, polyamide resin, polyester resin, polyurethane resin, polycarbonate resin, polyacetal resin, polyphenylene ether resin, a fluororesin, various kinds of thermoplastic elastomer, etc. are mentioned, for example, styrene resin, olefin system resin, methacrylic system resin, and polyvinyl chloride system resin are common in these. Two or more sorts of these can also be used.

[0026] Thus, the biodegradability polymer constituent of obtained this invention is fabricated by various Plastic solids by approaches, such as the well-known approach generally used for shaping of a thermoplastic polymer, for example, injection molding, extrusion molding, blow molding, inflation molding, and a vacuum forming. Moreover, it is fabricated by the desired Plastic solid after being fabricated by a film, a biaxially oriented film, a sheet, a foaming sheet, the foaming bead, etc.

[0027] Since the constituent of this invention uses a biodegradable plastic and starch as a principal component and a saccharide is added, while shaping to various moldings is easy and the moldings shows the various physical properties which plastics has, after an activity is thoroughly decomposed by the microorganism which lives soil, underwater, into sludge, etc. Moreover, the plastic of this invention can be used as fertilizer for a short period of time for the 1st day to about several days, if it processes with the compost for kitchen garbages. Using such



an outstanding property, the plastics constituent of this invention is fabricated by the various applications for which plastics is used conventionally, and can be used for them.

[0028] The desirable applications of this invention is enumerated and explained below.

[0029] 1. When the moldings of the constituent of a pile and pile this invention is directly used for soil, the microorganism in soil will decompose it by burying in soil. That is, it becomes the ideal application that an activity and abolition of a product are performed simultaneously. Specifically, it can be used as piles, such as grass stretched in the directions, such as a golf course, a route, and a river, and a pile. Moreover, it can be used also in the tree planting after work of landfill, a cut, etc., and a network flare. The whole work can also be made into biodegradability by changing to the conventional wire gauze and making the network itself into the product made from a biodegradable plastic of this invention simultaneously.

[0030] 2. It is suitable for the application and concrete target of which a sheet and films biodegradability are required to the house sheet for agriculture, the film for agriculture, the various films for a package, construction and the sheet for engineering works, a garbage bag, etc.

[0031] 3. Also in a container and a tray plastic, it is consumed especially so much and the disposal after abolition is suitable for the various difficult containers, tableware, a tray, a shipping box, a plantation art pot, etc.

[0032] 4. The constituent of charge this invention of foam can be made to foam easily by well-known approaches, such as the usual injection molding machine. Expansion ratio can also be adjusted from low foaming of about 2 to 3 times to high foaming of about 20 to 30 times.

[0033] An activity in the field for which plastics foam was used conventionally is possible. Especially low foam is suitable for the wheel of an automobile, a bumper, interior equipment, etc. with the materials for a package at the cabinet of an electric product etc. In addition, the application put in bearing in mind the lightweight nature and safeties, such as home interior equipment, the gear-tooth brush of a hotel, the spoon for aircraft eating in the household, a fork, tableware and a tray, toys, a ball of an air gun, and stationery, is included.

[0034] Especially high foam is effective as alternate material of the styrene foam which has a problem in current disposal. For example, shock absorbing material, such as shock absorbing material of boxes for transport, such as tableware containers, such as a container of a food tray and instant noodles, a marine product and the box for agricultural products, and a box for a package, and an electric product and a precision mechanical equipment, and the noise control and the heat insulator structural and for routes are suitable.

[0035] 5. In addition, it can also be made slit fiber, a nonwoven fabric, a network, a rope, etc. using being applicable to the various shaping approaches, and also application to motion implements, such as the pole of packaging materials, such as clothing, such as a hat, a poncho, and a wind deflector, a garbage bag, and a souvenir bag, and skiing, etc. can be performed. Moreover, application on the cards periodically discarded since various prepaid cards, such as a telephone card, an orange card, a pachinko card, and a books card, various credit cards, a library utilization card, various member cards, etc. are consumed by the large quantity or there is length is effective.

[0036] In addition, the front face of the Plastic solid acquired from the constituent of this invention can also be processed with various ingredients to raise further the water resisting property of a Plastic solid, chemical resistance, thermal resistance, a mechanical strength, etc. For example, processing of coating, a lamination, DIPIINGU, or vacuum evaporation is effective at metals, such as aluminum, non-biodegradable plastics, and the biodegradable plastics of others more, such as high-melting polylactic acid. Moreover, since it prevents that the biodegradability after an activity falls when processing a front face by metals and non-biodegradable plastics, surface treatment can be carried out only to the part which needs a water resisting property etc., or means, such as leaving a non-processing part selectively, can also be provided.

[0037] Furthermore, to objects for engineering-works tree planting, such as a pile, piles, a golf tee, a film for agriculture, a seedling pot, and a pot for plantation arts, the object for agricultural and forestry industries, and the materials supply for horticulture, if well-known fertilizer, such as Chisso, phosphorus, and potash, and an effective fungus are kneaded beforehand, since it will become still more effective as a part for fertilizer after biodegradation, it is desirable. Moreover, the addition rate is 5 - 30% of rate preferably 0 to 80%.

[0038]

[Embodiment of the Invention] Hereafter, although an example explains this invention in more detail, this invention is not limited to these examples.

[0039] (Example A) aliphatic series polyester The 47 sections (Show High Polymer Bionolle 1020)

(B) Corn starch 47 sections (C) cane sugar (sugar) The mixture of 6 section above-mentioned each component was supplied and fabricated to the injection molding machine. Mold goods were obtained using the metal mold of a tray and a pile.

[0040] The appearance of the obtained tray and a pile was good, and there was no generating of the scorch by the added cane sugar, discoloration, etc. Moreover, the mechanical strength as a tray and a pile etc. was enough, and washing by water was also possible.

[0041] the place which buried the above-mentioned tray and the pile and was left for three months under the room temperature in the culture medium collected and created from soil -- biodegradation was carried out nearly thoroughly.

[0042] While the moldability was inferior a little compared with the place which the cane sugar of the (C) component were excepted for the comparison, and also performed same shaping and decomposition, and the thing to depend on the example of above-mentioned this invention, the biodegradation in the inside of soil was not perfect, either.

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